Newland

NLS-CM50

Area Imaging Engine

Integration Manual

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Version History

Revisions	Description	Date
Pre-released	Pre-released version.	2012-05-21

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Preface

About This Manual

This Integration Manual provides specifications and installation instructions for the engine.

Chapter Introduction

- ***Introduction and Installation*** provides the installation instructions for the engine.
- ***Mechanical Specifications***provides the dimensions, interface connector and some design proposals.
- ***Electrical Specifications***describes DC Characteristics and AC Characteristics.
- ***Optics*** describes the requirements on optics design for the installation of the engine.
- ***Environmental Specifications*** describes the requirements on environment for use and reservation of the engine.
- ***Working with CM50*** describes operating modes of the engine and also the simple steps to handle it.

Chapter 1Introduction and Installation

About CM50

NLS-CM50 Area Imaging Engine, with small size and full automation design, is ideal as drop-in modules for OEM applications. Combined with Newland`s decoding software, NLS-CM50 can easily read all kinds of 2D and 1D bar codes as well as OCR fonts.

This chapter will provide the installation instructions for the engine.

ESD Precautions

CM50 is shipped in ESD safe packaging. Use care when handling the engine outside its packing. Be sure grounding wrist straps and properly grounded work areas are used.

Unpacking the Engine

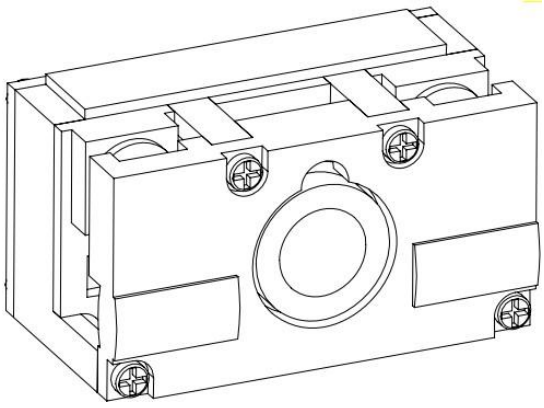
After you open the shipping carton containing the engine, please check to make sure everything you ordered is present and also check for damage during shipment. Report damage or short item immediately to your supplier. The shipping container is suggested to be saved for later storage or shipping.

Dust and Dirt

CM50 must be sufficiently enclosed to prevent dust particles from gathering on the imager and lens. Dust and other external contaminants will eventually degrade unit performance.

Mounting Orientation

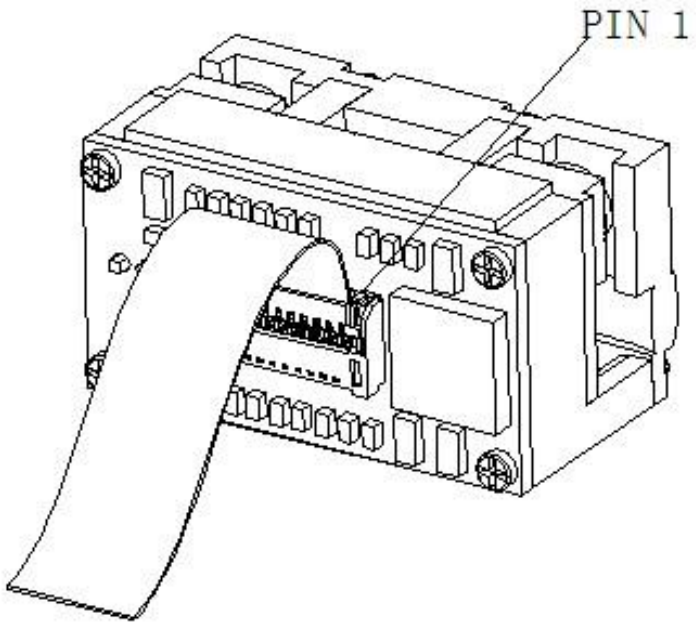
There are two machine screw holes on the bottom of the engine. When the engine is in right direction (as shown below), these two hole sites are downwards.



Interface Connector

Molex Connector 501912-2190 drawings taken from Molex Catalog page MX01. 0.3mm (0.012 in.) SMT, ZIF, Bottom Contact. Be carefulwhen handling the connector and flex strip so as to avoid any damage to the connector. The connection between flex strip and the connector should be solid and effective to ensure the engine`s normal work. Follow the connector manufacturer`s recommends to select suitable flex strip including thickness, contact material and geometry.

Connector Position and Flex Orientation



Connector Pinout

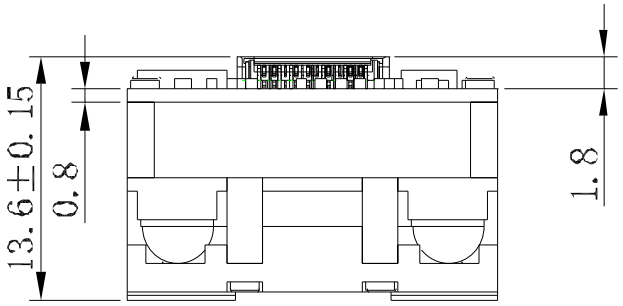
Pin	Signal Name	I/O	Description
1	GND	-	Power and signal ground.
2	Reserved	I/O	Reserved. (suggested to be connected to GPIO of microprocessor)
3	GND	-	Power and signal ground.
4	HSYNC (LINE_VALID)	O	High-when pixel data output
5	VSYNC (FRAME_VALID)	O	High-when pixel data output
6	Aimer On	I	Aimer LED controller, effective in high level. When Aimer is set under control of this pin, Aimer will be open in high level and off in low level. When Aimer is set internal automation, no level from this pin will effect Aimer.
7	Illumination On	I	Illumination LED controller, effective in high level. When Illumination is set under control of this pin, Illumination will be open in high level and off in low level. When Illumination is set internal automation, no level from this pin will effect Illumination.
8	Power Enable	I	CM50 is enabled to work when in high level of this pin, while comes into Standby Mode when in low level. It is suggested to default pull-down.
9	I^2C_SDA	I/O	I^2C Serial Interface Data. CM50 supplied with 10k ohm pull-up resistors.
10	I^2C_SCL	I	I^2C Serial Interface Clock.CM50 supplied with 10k ohm pull-up resistors.
11	Vin_LED	P	Power supply for LED illumination and aiming, voltage range is 3V~6V.
12	D0	O	Pixel data bit 0
13	Vin_Imager	-	Power supply for CIS and MCU, input voltage is 3.3V.
14	D1	O	Pixel data bit 1
15	D2	O	Pixel data bit 2
16	D3	O	Pixel data bit 3
17	D4	O	Pixel data bit 4
18	D5	O	Pixel data bit 5
19	D6	O	Pixel data bit 6
20	D7	O	Pixel data bit 7
21	PCLK	O	Pixel data timing clock.

Chapter 2 Mechanical Specifications

Outside View and Dimension

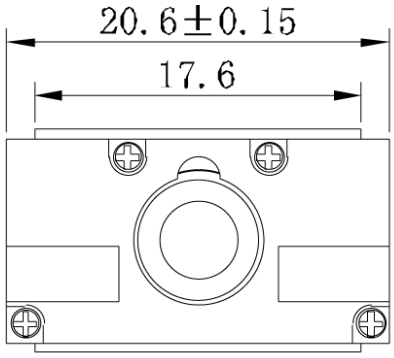
CM50 Top-side View

Unit：mm



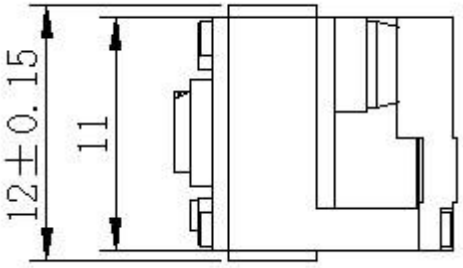
CM50 Front-side View

Unit：mm



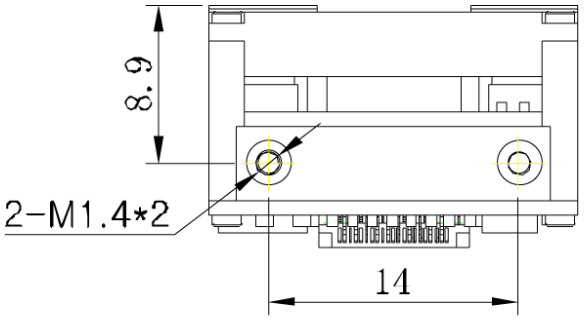
CM50 Left-side View

Unit：mm



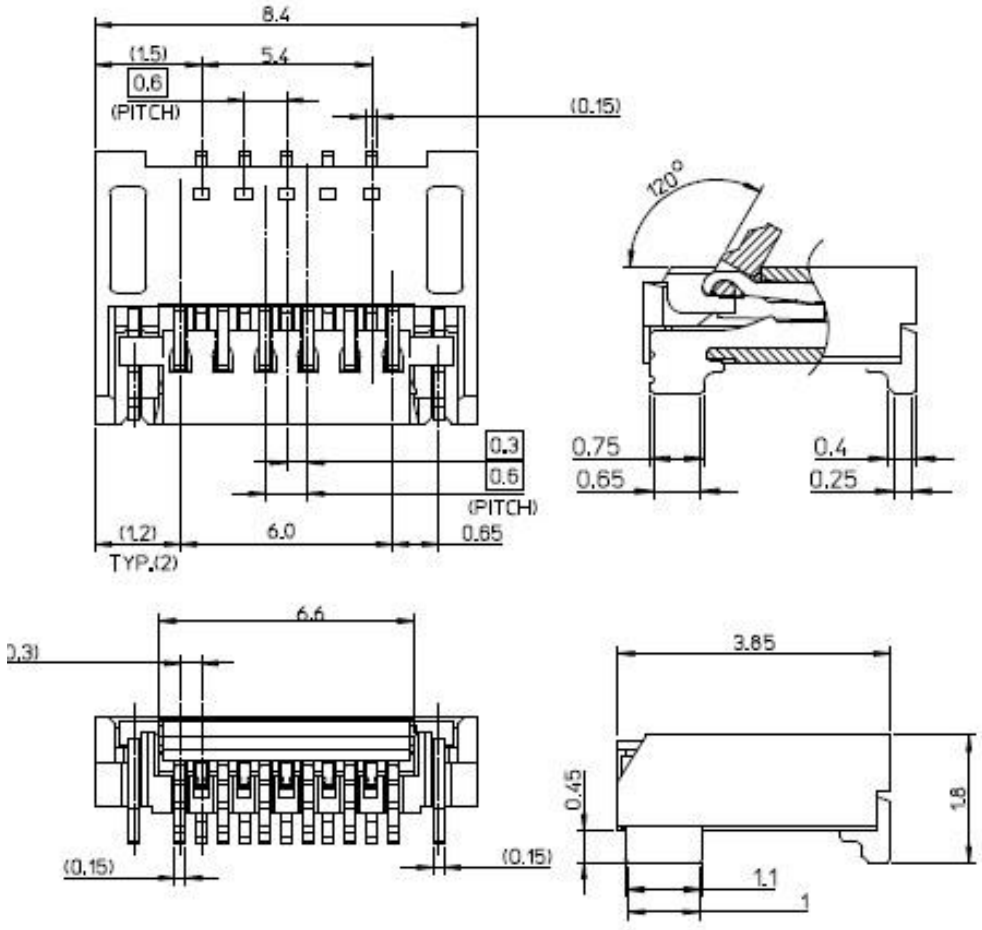
CM50 Bottom-side View

Unit：mm

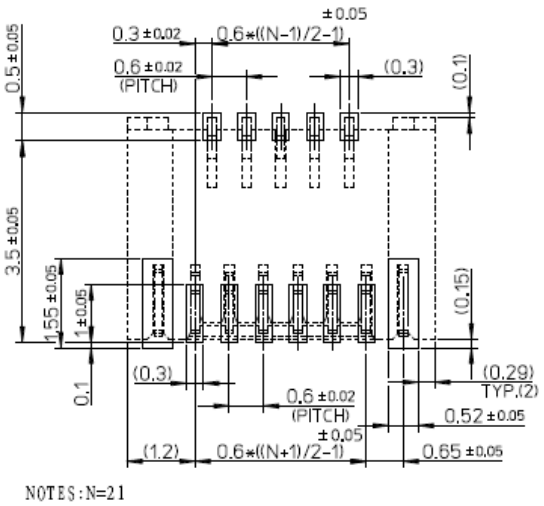


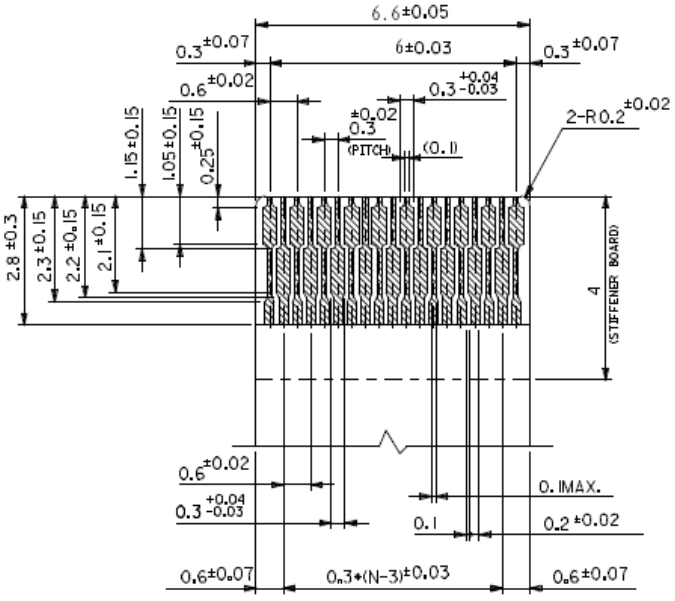
Connector

The connector of CM50 isMolex 501912-2190.



Recommended PCB subassembly of connector and flex strip specifications are illustrated below:





Design Proposal

Space for CM50 and flex strip should be taken into consideration during structure design so as to avoid any extrusion on components of CM50 or any damage on flex strip.

Chapter 3Electrical Specifications

DC Characteristics

Operation Voltage

TA = 25 ℃

	Description	Condition	Min.	Typical	Max.	Unit
Vin Imager	Imager Power		3.14	3.3	3.46	V
Vih	Input High Voltage	Vin Image=3.3V	2.8	-	3.6	V
Vil	Input Low Voltage	Vin Image=3.3V	-0.3	_	0.8	V
Voh	Output High Voltage	Vin Image=3.3V	2.6	_	_	V
Vol	Output LowVoltage	Vin Image=3.3V	_	_	0.3	V

	Description	Condition	Min.	Typical	Max.	Unit
Vin LED	LED Power		3V	-	6V	V

Current Draw

Vin_Imager = 3.3V, TA = 22 ℃

	Condition	
I_{In_Imager}	F_C = 26 MHz	95 mA
	F_C = 20 MHz	87 mA
	F_C = 14 MHz	72 mA

Vin_Imager = 3.3V, Vin_LED = 3.3V, TA = 22 ℃

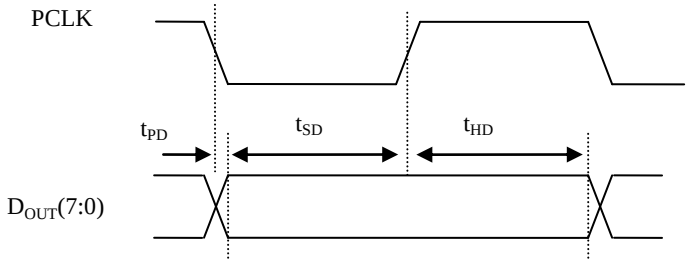
	Description	Condition	
$I_{Standby}$	Standby		<600uA
I_{Ready}	Ready		8 mA
I_{Peak}	Peak	F_C = 26 MHz	230
		F_C = 20 MHz	220
		F_C = 14 MHz	210
$I_{Average}$	Average Operating	F_C = 26 MHz	185
		F_C = 20 MHz	175
		F_C = 14 MHz	165

AC Characteristics

Pixel Clock Frequency

	Description	Min.	Typical	Max.
F_C	Pixel Clock – Full speed		26 MHz(default)	
F_C	Pixel Clock – Mode 2		20 MHz	
F_C	Pixel Clock – Mode 3		14 MHz	

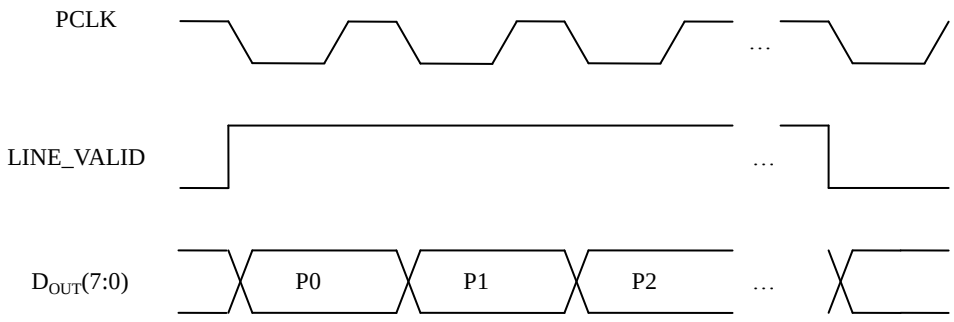
Propagation Delays for Pixel Clock and Data Out Signals



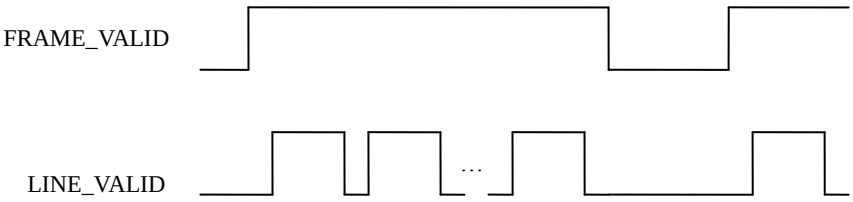
Vin_Imager = 3.3V; PCLK = 26.6MHz, TA = 25 ℃; CLOAD = 10 pF

	Description	Min.	Typical	Max.	Unit
t_{PD}	PIXCLK to Valid Data Out propagation delay	-2	0	2	ns
t_{SD}	Data setup time	14	16	-	ns
t_{HD}	Data hold time	14	16	-	ns

Line Valid Timing



Frame Valid Timing



Chapter 4 Optics

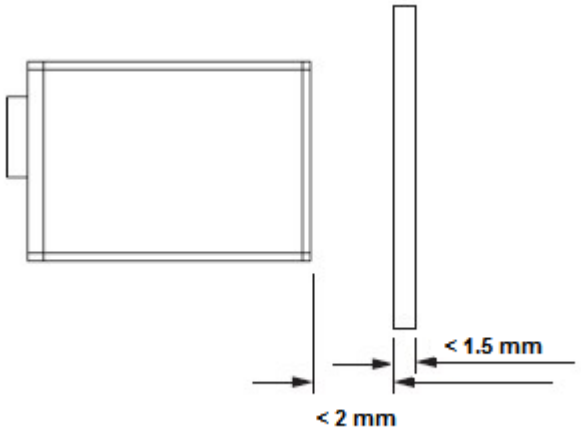
Window

Window is a transparent medium mounted front of the engine.

Window Placement

The window should be mounted close to the front of the engine (parallel, no tilt). The maximum distance is measured from the front of the engine housing to the farthest surface of the window. Since unwanted reflections can occur at either surface, the window thickness is suggested to be as thin as possible.

Recommended window placement is illustrated below:



Window Material Requirements

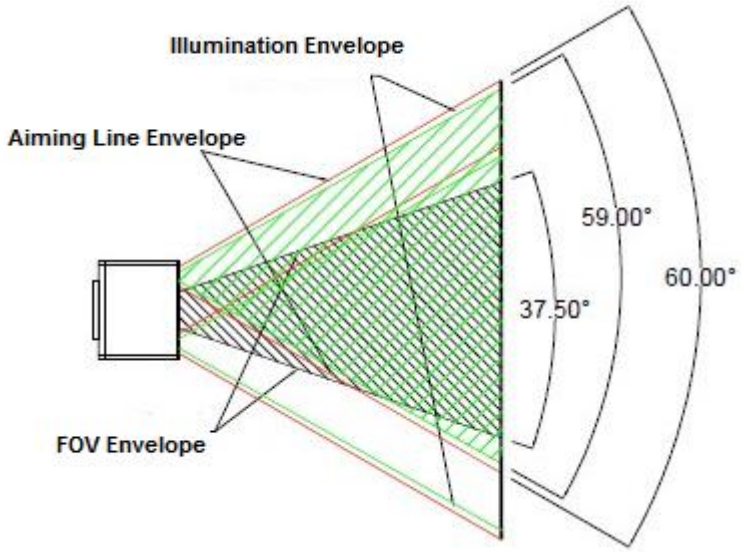
Window material must be clear and show high permeability to the illumination light wave of the engine (625±20nm).

The maximum allowable thickness for the window is 1.5 mm.

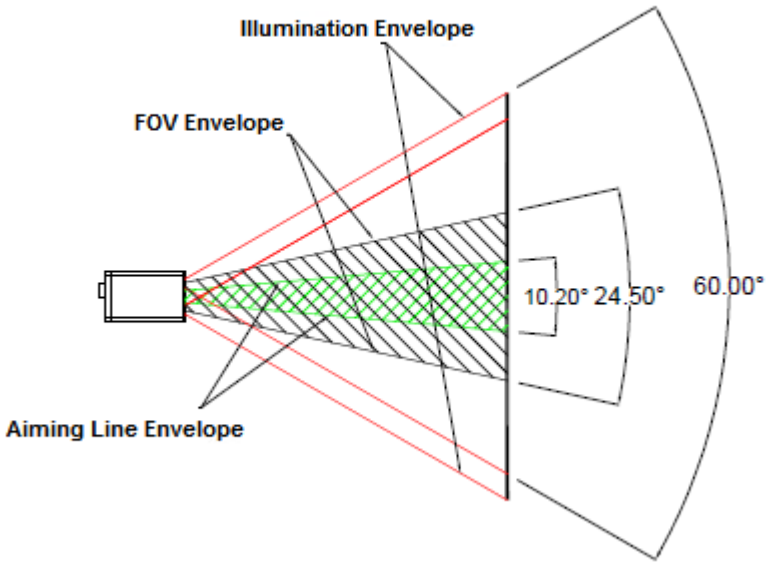
Window Size

Window size should be designed to ensure the illumination and aiming envelopes shown. The engine`s envelope diagrams are illustrated below.

CM50 Horizontal Envelope Diagram



CM50 Vertical Envelope Diagram



Barcode Presentation Angle

Bar codes printed on glossy or laminated paper are best read at angles greater than 6 ° in relation to the engine. This prevents bright illumination reflections from being returned to the engine.

Ambient Light

The engine performs best in the presenceof ambient light. In flash of high-frequency impulse, however, the engine`s performance might be degraded because of interence.

Eye Safety

No laser is used on the engine. The aiming and illumination depend on LEDs with red light wave of 625±20nm, which is safe for normal use.

The red light from LEDs is bright and should avoid direct vision or beam direct in the eyes.

Chapter 5 Environmental Specifications

Item	Specification
Operation Temperature	-10℃to 55℃
Storage Temperature	-40℃ to 85℃
Humidity	5% to 95% (non-condensing)

Chapter 6 Working with CM50

Serial Command Interface

I^{2}C serial controls the configuration read-write on the engine, so as to control the engine`s operating modes.

I^{2}C serial command presents the internal register in 8-bit. When the engine is in slave device mode, 0x24 is used as write-in address while 0x25 as read-out address. The engine supports reading multiple registers at one time.

Read-out a Register

E.g. Read from register 0xFD, returned value 0x01.

	1	2	3	4	5	6	7	8	9	10	11
Master	↓	↓		↓		↓	↓			↓	↓
	Start	ADDR 0x24	ACK	REG 0xfd	ACK	Start	ADDR 0x25	ACK	0x01	NACK	Stop
CM50			↑		↑			↑	↑		

Read-out Adjacent Registers

E.g. Read from register 0xF0,0xF1,0xF2, returned value 0x01,0x05,0x76.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Master	↓	↓		↓		↓	↓			↓		↓		↓	↓
	Start	ADDR 0x24	ACK	REG 0xf0	ACK	Start	ADDR 0x25	ACK	0x01	ACK	0x05	ACK	0x76	NACK	Stop
CM50			↑		↑			↑	↑		↑		↑		

Write-in a Register

E.g. Write to register0xFD with value 0x03.

	1	2	3	4	5	6	7	8
Master	↓	↓		↓		↓		↓
	Start	ADDR 0x24	ACK	REG 0xfd	ACK	0x03	ACK	Stop
CM50			↑		↑		↑	

Write-in Adjacent Registers

E.g. Write to registers 0x50,0x51,0x52 with value 0xec,0x37,0x20.

	1	2	3	4	5	6	7	8	9	10	11	12
Master	↓	↓		↓		↓		↓		↓		↓
	Start	ADDR 0x24	ACK	REG 0x50	ACK	0xec	ACK	0x37	ACK	0x20	ACK	Stop
CM50			↑		↑		↑		↑		↑	

Suspend

When register values have been written in the engine via I^2C, the engine will not respond I^2C communication during its repsonse to commands and the I^2C _SCL bus will be pulled down to low level. After the engine responds commands, I^2C _SCL will be pulled up and resume responding communication.

Response time vary among different commands. I^2C _SCL levels can be used to judge whether the engine is suspended for communication. Use serial command interface after communication is resumed.

Operating Mode

Standby Mode

It is the lowest power consumption mode for the engine. In this mode the engine is only influenced by the level change of Power Enable Pin. When Power Enable is in low level, the engine stays in Standby Mode ; while in high level, the engine is switched to Ready Mode.

No matter what mode the engine is in, when the Power Enable Pin is changed to low level, the engine will come into Standby Mode.

Ready Mode

The engine can receive I^2C communication in Ready Mode and handle communication messages such as initiating CIS to output images and illumination changes. In Ready Mode, CIS does not work or output image data. Ready Mode consumes less power than CIS Standy Mode.

CIS Standby Mode

Switch over to CIS Standby Mode from Continuous Mode so as to make CIS standby temperarily. The status parameters setted before coming into standby is saved and Continuous Mode can be resumed.

CIS Standby Mode can be switched to Continuous Mode, Ready Modeor Standby Mode.

Continuous Mode

When the engine is in Continuous Mode, CIS is running and outputs signals like Video Data, LINE_Valid, Frame_Valid and PCLK in a row. Meanwhile the CIS controls Aimer LED and Illumination LED .

Continuous Mode can be divided into three modes due to different PCLKs :

- ✧ Continuous Mode 1：PCLK is 26MHz，CIS output 58 fps。
- ✧ Continuous Mode 2： PCLK is 20MHz，CIS output 45 fps。
- ✧ Continuous Mode 3： PCLK is 14MHz，CIS output 31 fps。

The lower PCLK, the lower power is consumed and lower heat will occur.

Imager Registers

The table below describes general registers and bits. Those registers and bits have no description are reserved and should not be used at discretion.

Register	Bit	Desciption	default	Read/Write
0xF0	-	ID 1	0x01	R
0xF1	-	ID 2	0x05	R
0xF2	-	ID 3	0x76	R
0xF4 – Aimer	Bit 0	If set, when CIS is in exposure，aiming is on.	0x02	W
	Bit 1	If set, when CIS is not in exposure，aiming is on.		
	Bit 2	If set, only when Pin 6(Aimer On) is high, allows aimer to turn on with Bit 0/1 setting ; if Pin6 is low, aimer will not turn on even Bit 0/1 is set.		
0xF5 -- Illumination	Bit 0	If set, when CIS is in exposure, illumination is on.	0x01	W
	Bit 1	If set, when CIS is in exposure, illumination is on.		
	Bit 3	If set, only when Pin7(Illumination On)is high, allows illuminator to turn on with Bit 0/1 setting ; if Pin7 is low, illuminator will not turn on even Bit 0/1 is set.		
0xF8 – CIS Control	Bit 3	Row Flip Enable	0x20	W
	Bit 4	Column Flip Enable		
	Bit 5	AEC Enable		
0xFD – Run Mode	Bit [7:0]	0x01：Ready Mode 0x02：CIS Standby 0x03：Continuous Mode 1 0x08：Continuous Mode 2 0x09：Continuous Mode 3	0x01	W

4 Step Make it Working

After CM50 is installed/embedded into the deivce, connect to connectors (control and communication),the engine can be used follow the 4 steps or different combinations, for general applcaition.

Step 1：Power On

Set Power Enable (Pin 8) from Low level to Hig level andthe engine goes to Ready Mode.

Step 2：Ready, Go!

Modify register via I^2C communication to make 0xFD as0x03, then CM50 goest to Continuous Mode 1, the engine will automatically control CIS, Aiming LED, and Illumination LED, and output image frame.

Step 3：Pause

Modify register via I^2Ccommunication to make 0xFD as0x02, then CM50 goest to CIS Standby Mode, which pause CIS, Aiming LED, Illumination LED. If needs to pause with lower current, modify register via I^2C to make 0xFD as 0x01, and the enginegoes to Ready Mode. Repeat Step 2 to go to continuously automatic control and image output status.

Step 4：Standby

Modify register via I^2C to make 0xFD as 0x01, CM50 goes to Ready Mode ; set Power Enable (Pin 8) to be low level, the engine goes to Stanby Mode.

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